Large Whale Gear Research Summary

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Gillnet Research

In Situ Observations of Commercial Demersal Gillnets In situ observations of commercial gear were undertaken in waters located off the Massachusetts coast. The vertical profile of the gillnet observed during this investigation is typical of other bottom tending gillnets that are commonly set for round groundfish.

Land Testing of Gillnet Modifications A section of gillnet was loaded to simulate a whale while loads were measured in both the floatline and leadline. Weak link devices tested included knotted line, light line, plastic links, and Chinese fingers . The breaking strength of 6.5" and 7" 14 gage monofilament webbing was also tested. This land testing demonstrated that weak links placed in the floatline will fail, when a force is applied, and will release tension on the floatline as long as the gear offers enough resistance to allow the breaking strength of the weak link to be exceeded.

Low Strength Floatline Ten nets were built, 5 with 1/8" floatline and 5 with 3/16" floatline. These nets were used by fishermen and fished along with their typical gear. Significant problems were encountered handling the nets, as the small diameter floatline kinked and dipped through the meshes so badly that the gear was soon unfishable.

Gillnets with 6 Weak Links per Net Twenty nets were built with 1100 pound weak links installed in a traditional type of floatline at 8 fathom intervals. The construction techniques used for these nets eliminated the handling problems associated with the 1/8" & 3/16" floatline nets previously constructed.

Mega-Float Gillnets In 1999 10 gillnets were built incorporating a new type of floatline called *Mega-Float.* This floatline is constructed with internal flotation to eliminate the need for external floats along the length of the net. The elimination of the external floats would reduce the chance of the floatline getting hung up in a whale s baleen. The buoyancy of the mega-float floatline is about 15% less than traditionally rigged nets and is probably why some feedback from testing indicated the nets did not fish as well as traditional gear.

Weak Links in Gillnet Floatlines In the Summer of 2000 eighty nets were built utilizing 3 different strength weak links (600, 900 & 1100 lb.) Each net contained three weak links of the same strength, equally spaced along the floatline. These nets have been deployed in the Great South Channel and throughout the Gulf of Maine for one complete fishing season (12 months) with less than a dozen failures reported out of the 180 weak links tested. Reports of failures have been mostly when gear has been caught down on the bottom and lead line has already parted. Link failures have

spanned all of the 3 sizes of weak links with the 600 lb. Link registering over 75% of the failures.

Low Breaking strength line The NMFS Gear Research Team and the NMFS South East Region are currently contracting with cordage companies and polymer experts to develop a low breaking strength line to be used in the float line of sink gillnets. The challenge is to develop a line with the same diameter, floatation and stretch ratios as the line currently used, but with a reduced breaking strength (600 - 1100 pounds). Experimental line is expected to be available for at sea testing in gillnets by Spring 2002.

Next Generation Floatline Weak Link A manufacturer has developed a weak link that is inexpensive and easy to install on existing of new gear. This weak link design is also being developed for use in other areas of the gear.

Gillnet Experiments in the Bay of Fundy Load cells were utilized for measuring loads in gillnet gear aboard 3 commercial vessels while hauling and setting the gear.

Other Gillnet Load Cell Work A variety of measurements have been collected in various portions of gillnets during hauling, setting and fishing activities.

Development of Gillnet Friendly Load Cells Redesign of existing underwater load cells into a package more suitable for deployment on gillnets is ongoing.

Lobster Gear Research

In Situ Observations of Lobster Gear In situ observations of lobster gear were undertaken in waters located off the New England coast. Observations of composite buoy lines (sinking at the surface & floating at the trap end) as well as ground lines composed of floating rope and sinking rope were documented. The buoyline exhibited vertical profiles near the bottom and surface while the attitude of the transition section was related to the scope and lengths of the respective lines. The altitude off the bottom of floating groundline in a set of pair traps with a 10 fm groundline was measured as 3 fm.

Load Measurements in Lobster Gear A variety of measurements have been collected in various locations of lobster gear during hauling and setting activities.

Other Gear Research

Investigations of Natural Fiber Rope Tests were conducted to demonstrate how the strengths of two natural fiber ropes (sisal & cotton) decreased over time when subjected to a sea water environment.

Develop Neutrally Buoyant Rope Conferred with rope makers to produce and acquire a small quantity of rope that is neutrally buoyant in sea water. In trying to move away from floating rope, fishermen felt this concept might address some of the short falls of sinking rope relative to hanging down and chafing. The rope was rigged in lobster pot trawls and video documentation obtained via SCUBA diver.

Neutrally Buoyant Pilot Project Purchased about 18 thousand pounds (62 miles) of neutrally buoyant rope from three manufacturers & distributed along the coast from Nova Scotia to Connecticut aboard almost 100 vessels in lobster & gill net fisheries. Feedback in general was positive with exception of the offshore lobster fishery where 2 of the 3 types of line exhibited unacceptable rates of deterioration and inshore fishermen east of Penobscot Bay noted problems with the rope chafing and getting hung down.

Large Scale Offshore Neutrally Buoyant Rope Project Supplied an offshore lobster vessel with enough neutrally buoyant rope to rig over all of their gear. Approximately 50 miles of rope weighing close to 30 thousand pounds.

Galvanic Time Release Buoy System In the Summer of 2000, three separate experiments utilizing galvanic time release (GTR) buoy systems were set up throughout the Gulf of Maine. Hard plastic floats were attached to cement blocks with ten different links with varying release times. Buoy systems were checked daily and results recorded. The GTR s failed to surface on the predicted dates more than 50% of the time.

Low Cost Acoustic Release Buoy System Contract to develop a low cost system - contractor released for breach of contract - no product developed or delivered.

Thwartable Link - Bottom Release Contract to develop a bottom weak link strong enough to hold the buoy & buoyline to the gear, but not strong enough to haul the gear until a command from the surface defeats the weak link. Contractor defaulted on contract - no product developed or delivered.

The Design, Testing and Production of Mechanical Weak Links for Fishing Gear , P. Anderson, Ohio State University. Development of two types of weak link devices - 1) Flat link, manufactured from high molecular weight polyethylene, and 2) a *lap-joint* weak link, manufactured using flexible, adhesive lined, polyolefin tubing that shrinks to 1/3 the original diameter when heated. The flat links could be manufactured to appropriate tensile strengths however, they did not perform well under torsional and bending loads. The *lap-joint* weak links revealed that failure loads ranging from approximately 450 pounds to over 1200 occurs, depending on the number of layers of tubing, the length of the lap joint, the test temperature, and the rope material, diameter, and condition.

Design, Testing and Evaluation of an Acoustic Release System for Offshore Lobster Pot Lines , J. DeAlteris. Project was to develop a cost effective prototype acoustic release system for the buoy end line of offshore lobster gear. The final product was a prototype system that carries 1000 feet of hauling rope and will operate in depths up to 600 feet. The system was successfully tested at sea aboard lobster vessels in the Gulf of Maine and demonstrates proof of concept.

Development of Bottom Weak Links and Buoy Line Messenger System , R. Smolowitz and D. Wiley. Work to develop a weak link device that is time (as opposed to force) sensitive. This delayed release device would allow the gear to be hauled for a pre-specified period of time before releasing. The messenger system is patterned after the common oceanographic practice of sending a weighted device down a line to perform a function at the bottom of the ocean. In this application the device would provide a way to send a heavy hauling line down a light, easily broken tag line that is attached to the gear. Once the messenger is attached to the gear, the hauling line is used to retrieve the gear.

Force Measurements of Rope Sliding Through Baleen Measurements of forces required to pull ropes of various diameters through baleen plates were conducted in the laboratory and in-situ for several species, including blue whale, humpback, and right whales.

Weak Link Tests Laboratory testing of various weak link techniques including: knots, hog rings, wooden toggles, cutting one strand, various buoy stick attachment techniques, plastic cable ties, etc.

Estimation of the Tractive Force for the Northern Right Whale, A. Fridman, D. Williams, J. Guimond, & J. DeAlteris. This report develops estimates of the propulsive and tractive forces that a right whale would be capable of. Maximum propulsive force estimates ranged from 465 pounds for a 13 foot whale to 9440 pounds for a 60 foot whale at 20 knots. Maximum estimates of tractive force determined by the method of Fridman, ranged from 135 pounds to 6969 pounds for the same species and size range.

Development of Off-the-Shelf Weak Links Supported the development and production of weak links that would make 500, 600 & 1100 pound off-the-shelf weak links available to industry.

Gear Retrieval Utilizing a Light Buoy Line A light (weak) buoy line is used to mark the gear as well as to retrieve the hauling line that is stored at the bottom with the gear. The light buoy line only needs to be strong enough to hold the buoy to the gear, thus it would pose a minimum threat to marine mammals.

Research Outside NMFS

The Design, Production and Sea Testing of Modern Mould Sliplink™ Knotless System, D. Paul and G. Ostrom. Development and testing and production of a knotless weak

link system. Initial design resulted in units with load ratings 150 to about 250 pounds. Redesigned to a unit with a 400 pound load rating.

Acousticlly Triggered Buoyless Lobster Trap Recovery System, Sea Grant, NH/ME. Design and development of a prototype acoustic buoy release system.

Photo Degradable Rope Development, D. Allen. eubalaena award

Development of a Breakaway Unit for Lobster Pot Buoy Lines, E. deDose

Use of Light and Illuminated Ropes to Prevent Right Whale Entanglement, S. Kraus

Operational Testing of a Low Strength Weak Link for Surface Buoys and a Knotless Line Fastener for Reducing the Risk and Consequences of Right Whale Entanglement, S. MacKinnon

Gear Modification to Address Right Whale Entanglement, G. Ostrom

Design of a Whale Safe Buoy, C. Goudey